

Application Serial No.: 10/821,755  
Reply to Office Action of July 09, 2008

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### REMARKS/ARGUMENTS

Favorable consideration of the present application and the above claims is respectfully requested.

Claims 1 – 22 were pending in the application as originally filed. Claims 5-7, 9, 15-17 are canceled since they are incorporated into the relevant independent claims. Claim 6 is canceled in this amendment. The claims now pending are 1-4, 8, 10-14, 18-22.

Independent claims 1, 2, 3, 4, 10 and 18 are amended to limit the scope of Applicant's invention as a 3-bit, 0-1-2 ternary encoding scheme for WORM (Write Once Read Many Times) optical data storage on a compact disc (CD) or digital video disc (DVD) based on two-photon induced recording and two-photon fluorescence readout technology. The terminology, "consisting essentially of" replaces the term, -- comprising—which now excludes unintended elements, compositions and processes.

In addition, independent claims 1, 2, 3, 4, and 10 are amended to define the data storage medium as "... one of a compact disc (CD) and a digital video disc (DVD)", as is claimed in original independent claim 18 and taught in the specification at page 6, lines 1 and 20-21, Table 1, Fig. 10 and Table 4.

No new matter is added by the foregoing amendments.

Applicant now responds to the detailed action starting with a statement of Applicants' invention, as now claimed: Applicant's invention increases the data storage capacity in a data storage medium (CD or DVD), by at least 50%, using a 3-bit, 0-1-2 ternary encoding scheme rather than a 2-bit, 0-1 binary encoding scheme, wherein both image writing and reading are accomplished via near-IR two-photon excitation creating fluorescent values in a transparent polymer impregnated with a reactive dye (fluorophore) and a photo-acid

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generator. Prior to Applicant's invention, it was not known that a chemical process would yield image formation within a photosensitive polymeric film containing a photo-acid generator and an acid-sensitive fluorophore, which allows two-photon induced fluorescent imaging and readout.

On page 2, paragraph 1 of the Office Action of January 21, 2009, the Examiner acknowledges the terminal disclaimers filed by applicant and indicates that certain rejections were withdrawn in view of the amendments to claims.

On page 2, paragraph 2 of the Office Action of January 21, 2009, the Examiner objects to Claim 6 under 37 CFR 1.75 (c), as being of improper dependent form for failing to further limit the subject matter of a previous claim and states, "This limitation is already present in claim 4." Applicant has canceled Claim 6 and respectfully requests that all objections and rejections directed to Claim 6 be withdrawn, since the matter is now moot.

On page 2, paragraph 3 of the Office Action of January 21, 2009, the Examiner provides the statutory basis for all obviousness rejections set forth in this Office action and makes a first rejection of Claims 1-4,6, 10 and 18-19 as being unpatentable over Devoe, et al. (WO 01/96952) in view of Sysak (U.S. Patent 4,341,860), Iwakura, et al. (U.S. Patent 4,484,682), Bhawalker, et al. "Two photon laser scanning fluorescence microscopy...", *Bioimaging*, 1996, pp. 168-178, vol. 4, and Davis (U.S. Patent 3,413,071).

The Examiner argues that, "Devoe et al. WO 01/96952 teaches two photon imaging as means for controlling the area of exposure ... in three dimensions and the ability to write features below the diffraction limit. The use of a ti:sapphire laser... sensitizers...dye precursor...binders... fluorene sensitizers... fluorescence of the photosensitizers..." are disclosed.

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The Examiner has selectively found several elements of Applicant's invention, however, the missing elements are the inventive steps. Devoe DOES NOT use fluorene dyes for fluorescent properties in writing, storing and reading out data from CDs or DVDs and does not suggest, teach or motivate one to provide such an invention.

Applicant does not form colored patterns or images as taught by Devoe; in contrast, Applicant's invention increases the data storage capacity in a data storage medium (CD or DVD), by at least 50%, using a 3-bit, 0-1-2 ternary encoding scheme rather than a 2-bit, 0-1 binary encoding scheme, wherein both image writing and reading are accomplished via near-IR two-photon excitation creating fluorescent values in a transparent polymer impregnated with a reactive dye (fluorophore) and a photo-acid generator.

In contrast, Devoe et al. teaches a two-photon process that includes dyes and dye precursors and photoacid generator to form a multicolor image in a printing process; there is no suggestion of a process for increasing data storage capacity on a CD or DVD; nor is there any disclosure regarding image writing and reading using a 3-bit, 0-1-2 ternary encoding scheme.

It is clear that Devoe et al. teach and claim multicolor imaging – not multilayer data storage and readout on CDs and DVDs, as does Applicant.

To compensate for the missing teachings in Devoe et al, the Examiner states that “Sysak ‘860 teaches the formation of ... leuco dye images...uses lasers in the imaging process.. binders include PMMA and polystyrene... “ and Iwakura et al. ‘682 teaches various leuco dyes including...fluorene compounds..useful binders ...use of iodonium or sulfonium compounds...” Bhawalkar et al “....teaches confocal imaging with detection of the full ...fluorescent spectrum...” and Davis ‘071 teaches the “...colored fluorene dye exhibits

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fluorescence...” The Examiner concludes, “It would have been obvious to one skilled in the art to **modify** [bold type and underlining for emphasis] example 2 of Devoe et al. by replacing...phenoxazine dye with a fluorene dye...as disclosed by Iwakura et al. ‘682 based on the disclosure of equivalence...with a reasonable expectation multivalued tonal images ... leuco dye images by Sysak’860...using a scanning confocal microscope ...disclosed by Devoe et al. ...or Bhawalkar et al...to collect full spectrum data from the imaged areas with a reasonable expectation of capturing a fluorescent image based upon Davis ‘071 teaching that colored fluorene dyes exhibit fluorescence and the teaching of the fluorescence of the photosensitizers by Devoe et al....”

Applicant finds the above arguments based on an unreasonable hypothetical calling for the modification of example 2 of Devoe et al. Applicant has narrowed the claims and limited the scope thereof by using the language, “consisting essentially of” and included a limitation on the type of storage medium, namely CD or DVD, for writing, storage and read out of data, as suggested by the Examiner. Neither Devoe et al. alone or in combination with Sysak ‘860, Iwakura ‘682, Bhawalkar (1996) and David’071 teach writing and storing data on CDs or DVDs and more specifically increasing the storage of data by approximately 50%.

Hypothetical modifications in chemistry are highly suspect. In *In re Carleton*, 202 USPQ 170 (CCPA, 1979) the court stated, “Although there is a vast amount of knowledge about general relationships in the chemical arts, chemistry is still largely empirical, and there is often great difficulty in predicting precisely how a given compound will behave.” Further, the court quotes from *Schering Corp. v. Gilbert*, 153 F. 2<sup>nd</sup> 428, 433, 68 USPQ 84, 89 (2d Cir., 1946),”...while analogy is at times useful, ... chemistry is essentially an experimental science and results are often uncertain, unpredictable and unexpected.”

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Noting that the rejection of canceled Claim 6 is now moot, Applicant respectfully requests the withdrawal of the rejection of Claims 1-4, 10 and 18-19 as being unpatentable over Devoe, et al. (WO 01/96952) in view of Sysak (U.S. Patent 4,341,860), Iwakura, et al. (U.S. Patent 4,484,682), Bhawalker, et al. "Two photon laser scanning fluorescence microscopy...", *Bioimaging*, 1996, pp. 168-178, vol. 4, and Davis (U.S. Patent 3,413,071).

On page 5, paragraph 4 of the Office Action of January 21, 2009 the Examiner rejects claims 1-4, 6, 10, 18 and 19 under 35 U.S.C. 103(a) as being unpatentable over Devoe, et al., in view of Sysak '860, Iwakura, et al. '682, Bhawalkar, et al, *Bioimaging* vol. 4 pp. 168-178 (1996), and Davis '071, further in view of Marder, et al. '913.

The Examiner credits Marder et al. with teaching "...the use of binders in two photon absorbing compositions...writing three dimensional media... and 733nm [two photon absorption maxima]." Then concludes, "It would have been obvious to modify the processes and media rendered obvious by the combination of Devoe, et al., in view of Sysak '860, Iwakura, et al. '682, Bhawalkar, et al, (1996) and Davis '071 by using other laser wavelengths such as 733 nm, in place of the 800 nm used in the invention with a reasonable expectation of forming the desired images with an increased sensitivity based on the two photonabsorption maxima... taught by Marder et al...."

The Examiner states that the reliance on Marder et al. is "...only for the inherency of the absorption of the sensitizing dye used in example 2 of Devoe et al...." A reference that teaches the absorption of the sensitizing dye does not facilitate, make obvious or suggest Applicant's invention which increases the data storage capacity in a data storage medium (CD or DVD), by at least 50%, using a 3-bit, 0-1-2 ternary encoding scheme rather than a 2-bit, 0-1 binary encoding scheme, wherein both image writing and reading are accomplished

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via near-IR two-photon excitation creating fluorescent values in a transparent polymer impregnated with a reactive dye (fluorophore) and a photo-acid generator. Prior to Applicant's invention, it was not known that a chemical process would yield image formation within a photosensitive polymeric film containing a photo-acid generator and an acid-sensitive fluorophore, which allows two-photon induced fluorescent imaging and readout.

Applicant's claims are now amended to more precisely claim the invention.

In view of the arguments and amendments to claims, the rejection of canceled Claim 6 is now moot; Applicant respectfully requests the withdrawal of the rejection of Claims 1-4, 10, 18 and 19 under 35 U.S.C. 103(a) as being unpatentable over Devoe, et al., in view of Sysak '860, Iwakura, et al. '682, Bhawalkar, et al, *Bioimaging* vol. 4 pp. 168-178 (1996), and Davis '071, further in view of Marder, et al. '913.

On page 6, paragraph 5 of the Office Action of January 21, 2009, Claims 1-4, 6, 8, 10-14 and 18-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Devoe, et al., in view of Sysak '860, Iwakura, et al. '682, Bhawalkar, et al, *Bioimaging* vol. 4 pp. 168-178 (1996), Davis '071, and Marder, et al. '913, further in view of Glushko et al. '671 and Fourkas et al. '063.

The Examiner argues that, "Glushko et al. teach the formation of fluorescent multilayered optical recording media...100 or more layers...use of multiple fluorescent detectors..." and Fourkas et al. "...teach the variation in the power and duration to control the data bit size.... The media can be doped into a porous medium or coated as a multilayered form..."

Thus, the Examiner states, "It would have been obvious to ...modify the processes or media using two or three layer embodiments rendered obvious by the combination of Devoe,

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et al., in view of Sysak '860, Iwakura, et al. '682, Bhawalkar, et al, Bioimaging vol. 4 pp. 168-178 (1996), Davis '071, and Marder, et al. '913 by adding other layers of up to 100 or more with spacers based upon the teachings of Glushko et al. and Fourkas et al, as each layer will increase the information density of the medium."

Applicant respectfully disagrees and has amended claims herein to more precisely claim the invention. Applicant does not form colored patterns or images in a multicolor printing process described by Devoe et al. nor practice the combination of techniques disclosed in Sysak '860, Iwakura, et al. '682, Bhawalkar, et al, Bioimaging vol. 4 pp. 168-178 (1996), Davis '071, and Marder, et al. In contrast, Applicant's invention increases the data storage capacity in a data storage medium (CD or DVD), by at least 50%, using a 3-bit, 0-1-2 ternary encoding scheme rather than a 2-bit, 0-1 binary encoding scheme, wherein both image writing and reading are accomplished via near-IR two-photon excitation creating fluorescent values in a transparent polymer impregnated with a reactive dye (fluorophore) and a photo-acid generator.

Neither reference alone or in combination stores data on a transparent polymeric medium (CD or DVD); neither reference alone or in combination uses 3-bit, 0-1-2 ternary encoding scheme to increase the data storage and there is no teaching, suggestion or motivation to use a transparent polymeric material impregnated with a photoacid generator and a reactive fluorene dye to achieve the data storage and readout results claimed by Applicant.

In In re Rouffet, 47 USPQ 2d 1453, at 1457-1458 (Fed. Cir. 1998), the Court said "[t]o prevent the use of hindsight based on the invention to defeat patentability of the invention, this court requires the examiner to show a motivation to combine the references

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that create the case of obviousness. In other words, the examiner must show reasons that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed."

Applicant uses a chemical process that yields image formation within a photosensitive polymeric film impregnated with a photoacid generator and an acid-sensitive reactive fluorene dye, which allows two-photon induced, dual-channel fluorescence data storage and readout using a 3-bit, 0-1-2 ternary coding scheme increasing data storage on CDs and DVDs.

In view of the arguments and amendments to claims, Applicant notes that the rejection of canceled Claim 6 is moot and respectfully requests the withdrawal of the rejection of Claims 1-4, 8, 10-14 and 18-22 under 35 U.S.C. 103(a) as being unpatentable over Devoe, et al., in view of Sysak '860, Iwakura, et al. '682, Bhawalkar, et al, *Bioimaging* vol. 4 pp. 168-178 (1996), Davis '071, and Marder, et al. '913, further in view of Glushko et al. '671 and Fourkas et al. '063.

In paragraph 6 on page 7 of the Office Action of January 21, 2009, Claims 1-4, 6, 8, 10-14, and 18-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Devoe et al., WO 01/96952, in view of Sysak '860, Iwakura, et al. '682, Bhawalkar, et al, *Bioimaging* vol. 4 pp. 168-178 (1996), Davis '071, Marder, et al. '913, Glushko et al. '671 and Fourkas et al. '063 further in view of Rentzepis et al. '031 and Tanaka et al. "Rapid sub-diffraction limit laser micro/nano processing in a threshold material system," *Appl. Phys. Lett.*, Vol. 80(2) pp. 312-314 (01/2002).



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The Examiner states that Rentzepis et al. '031 "...teach 100 planes of data...use of 3D media which are a cube..." and Tanaka et al. "...teaches the formation of submicron features...using two photon excitation processes with a Ti:sapphire operating at 780 nm and 150 fs pulse width..."

Applicant maintains the arguments above regarding the patentability of the subject invention over Devoe et al. (formation of colored patterns or images in a multicolor printing process) in combination with Sysak '860 (formation of ... leuco dye images...using lasers in the imaging process.. binders include PMMA and polystyrene...), Iwakura et al. '682 (leuco dyes including...fluorene compounds.. binders ...use of iodonium or sulfonium compounds), Bhawalkar et al (confocal imaging with detection of the full ...fluorescent spectrum), Davis '071 (colored fluorene dye exhibits fluorescence), Marder, et al. '913 (using a two-photon absorber to sensitize various reactions, including polymerization and writing in three dimensional media), Glushko et al. '671 (formation of fluorescent multilayered optical recording media) and Fourkas et al. '063 (variation in power and duration to control data bit size); further in view of Rentzepis '031 Rentzepis et al. (polymerizing a monomer containing dyes using acid generating species and two photon recording to form a cube or "useful three-dimensionally imaged article") and Tanaka et al. (formation of submicron sized features with laser).

The added teachings of Rentzepis et al. and Tanaka et al. provide no teaching or suggestion that would defeat the patentability of Applicant's invention.

The common thread in the Examiner's combination of references is the recording of data or images; not one reference alone or in combination teaches or suggests the fluorescent readout of stored data; not one reference alone or in combination teaches or suggests the use

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of CDs or DVDs as the storage medium; not one reference alone or in combination teaches or suggests that data storage capacity can be increased by 50% using a 3 bit ternary encoding scheme rather than a 2-bit binary encoding scheme.

In contrast, Applicant's invention uses two-photon absorption to increase data storage capacity in a data storage medium (CD or DVD), by at least 50%, using a 3-bit, 0-1-2 ternary encoding scheme rather than a 2-bit, 0-1 binary encoding scheme, wherein both image writing and reading are accomplished via near-IR two-photon excitation creating fluorescent values in a transparent pre-formed polymeric material impregnated with a reactive dye (fluorophore) and a photo-acid generator.

Applicant's amended claims make it clear that Applicant does not form colored patterns or images in a multicolor printing process described by Devoe et al; nor is there anything in Applicant's combination of materials that would undergo polymerization, as in Marder et al. The additional references do not cure the invalid rejection.

To reiterate, Applicant teaches and claims an invention that increases the data storage capacity in a data storage medium (CD or DVD), by at least 50%, using a 3-bit, 0-1-2 ternary encoding scheme rather than a 2-bit, 0-1 binary encoding scheme, wherein both image writing and reading are accomplished via near-IR two-photon excitation creating fluorescent values in a transparent polymer impregnated with a reactive dye (fluorophore) and a photo-acid generator.

The rejection of canceled Claim 6 is now moot; Applicant respectfully requests the withdrawal of the rejection of pending Claims 1 – 4, 8, 10-14, and 18-22 under 35 U.S. C. 103(a) as being unpatentable over Devoe et al., WO 01/96952, in view of Sysak '860, Iwakura, et al. '682, Bhawalkar, et al, *Bioimaging* vol. 4 pp. 168-178 (1996), Davis '071,

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Marder, et al. '913, Glushko et al. '671 and Fourkas et al. '063, further in view of Rentzepis et al. '031 and Tanaka et al. "Rapid sub-diffraction limit laser micro/nano processing in a threshold material system," *Appl. Phys. Lett.*, Vol. 80(2) pp. 312-314 (01/2002).

Applicant's invention is not suggested or in anyway made obvious by the references cited by the Examiner because none of the references suggest increasing data storage capacity in a CD or DVD, using a 3-bit, ternary encoding scheme, wherein both image writing and reading are accomplished via near-IR two photon excitation creating fluorescent values in a transparent pre-formed polymeric material, such as PMMA or polycarbonate impregnated with a reactive fluorine dye and a photo-acid generator.

In *In re Nomiya*, 184 USPQ 607 (CCPA, 1975), the court holds, "There must be a reason apparent at the time the invention was made to the person of ordinary skill in the art for applying the teaching at hand, or use of the teaching as evidence of obviousness will entail prohibited hindsight."

In view of Applicant's arguments and amendments to claims, the application and pending Claims 1 – 4, 8, 10-14, and 18-22 are believed in condition for allowance; allowance is respectfully requested.

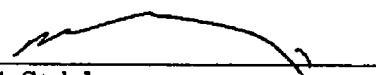
If the Examiner believes that an interview would be helpful, the Examiner is requested to contact the attorney at the below listed number.

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Respectfully submitted,

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